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ABSTRACT

This pamphlet discusses open courseware, exploring its origin and educational potential. "Courseware" includes educational software and electronic course materials. "Open courseware" describes courseware that gives users a significant degree of openness (or accessibility) to these course materials. The courseware provides a technological and legal framework to deliver course materials to teachers and students on demand, holding the potential to overcome economic, temporal and geographic obstacles. This document reviews general strategies and methods for integrating open courseware into the curriculum and examines this courseware's permitted uses and education potential. Unlike other electronic education materials, open courseware is distributed without charge and is disseminated electronically, rather than through printed media, to keep costs down. The document discusses the original source material used in open courseware and cautions that open courseware is copyrighted and is not therefore in the public domain. It describes the typical components of this courseware, as well as the various formats in which it is found. Since each teacher is unique, open courseware serves a valuable role by being adapted into a curriculum in varying degrees of completeness and complexity. Three case studies that demonstrate the use of open courseware are provided. (RJM)

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Kenyon D. Potter

2003

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Using Open Courseware in Curriculum Development

Kenyon D. Potter

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Kenyon David Potter is a professional engineer, educator, and writer in California. He received a bachelor of science degree from the Massachusetts Institute of Technology; a master of science degree from the University of California, Berkeley; and a law degree from the University of California, Hastings College of the Law.

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Series Editor, Donovan R. Walling

Using Open Courseware in Curriculum Development

by
Kenyon D. Potter

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Table of Contents

Introduction 7

A Vision of Openness 8
- What Is Open Courseware? 9
- What Are Permitted Uses? 10
- Education Potential 11

Open Courseware Distinctions 13
- Original Source Materials 14
- Public Domain Materials 15
- Lesson Plans 15
- Distance Education 16

Components of Open Courseware 17
- Typical Components 17
- Optional Components 18
- Excluded Components 19
- Open Courseware Formats 20

Making Curriculum Decisions 23
- Types of Use 24
- Adjusting Open Courseware 26

Case Studies 28
Case No. 1: Managing the Digital Enterprise ... 28
Case No. 2: The Harvey Project 29
Case No. 3: MIT's Biology Hypertextbook 30

Other Considerations 31

Conclusion 33

Resources 35

Introduction

A novel way to bring much-needed advanced curricula to schools in which resources are limited can be found in open courseware. In high schools without advanced classes as part of their curriculum or insufficient resources to develop advanced classes, open courseware can provide material at little to no cost. Free course materials are available for advanced classes in mathematics, science, and other subjects that are important for college preparation.

In this fastback, the reader will learn about open courseware and explore its origin and educational potential. I will review general strategies and methods for integrating open courseware in the curriculum. Finally, I also will examine case studies of the development and use of open courseware and review a list of current and projected open courseware resources.

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A Vision of Openness

Openness is an important characteristic of many physical and social systems. Education systems are no exception. Examples of openness in education systems include open universities, open campuses, and open courseware. Open universities allow students to register, attend classes, and receive credit without formal admittance to the university. Open campuses allow students the flexibility to come and go from campus without advance permission. Open courseware allows teachers and students to access and make noncommercial use of various course materials from other institutions without charge.

> "Open courseware looks counter-intuitive in a market-driven world. It goes against the grain of current material values. But it really is consistent with what I believe is the best about MIT. It is innovative. It expresses our belief in the way education can be advanced — by constantly widening access to information and by inspiring others to participate." Charles M. Vest, President, MIT (2001)

What Is Open Courseware?

The term "courseware" includes both educational software and electronic course materials. The term "open courseware" describes courseware that gives users a significant degree of openness (or accessibility) to such course materials. Open courseware provides a technological and legal framework to deliver course materials to teachers and students on demand. It has the potential to overcome many obstacles, including economic, temporal, and geographic barriers, by enabling global access to information.

Open courseware may be distributed to users on computer disks, by e-mail, as online publications, or by a combination of these methods. The distribution of open courseware frequently is accomplished by online publication of course materials. Online publication maximizes accessibility and is economical because of the minimal distribution cost, thereby making feasible the efficient publication of open courseware without charge.

Open courseware is *not* in the public domain. Rather, it is similar in concept to "open source software," in that each is accessible. The principle of open source software is to allow access to the source code — the underlying component of software — in order to foster review and criticism that leads to advances to the source code. Similarly, the principle of open courseware is to enable access to course materials in order to foster advances in education. The openness of both open source software and open courseware is in the tradition of scientific and literary criticism.

Open courseware also is similar in concept to "freeware" in that each is distributed without charge. Like freeware, open courseware is copyrighted and may be used subject to the terms of the license. Open courseware is protected by copyright whether the course materials are original creations or compilations of public domain materials selected and arranged as open courseware. The "free" aspect of both freeware and open courseware is based on the fact that both enable access and permit at least some measure of use without charge.

What Are Permitted Uses?

Before proceeding to the educational benefits that may be derived from use of open courseware, it is necessary to review possible limitations to permitted uses. Open courseware is copyrighted, and so the use of open courseware is subject to the terms of a license. An open courseware license typically permits certain uses, including copying, distributing, and adapting the course materials. Frequently, a license may permit nearly unrestricted use — including indirect commercial use — provided that permission on the same terms is granted to so-called downstream users. For example, if a user of open courseware adapts the open courseware by modifying its components, that user must grant permission to others to use the adapted course materials. In addition, the user typically must cite the author or publisher of the courseware.

A user license also may prohibit commercial use. The term "commercial use" may be defined very broadly or

narrowly by the terms of a license. By any definition, the resale of open courseware is commercial use. A teacher charging for copies of the courseware is commercial use and probably not allowed. A broad definition of commercial use may exclude distribution by institutions and schools that charge tuition or instructional fees. These schools may be excluded from distributing open courseware, whether or not they have nonprofit status. In contrast, public K-12 schools generally would be permitted to copy and distribute open courseware because they do not charge tuition. I would caution readers to refer to the language of a license for permitted uses and specific use restrictions. Regardless of permitted uses, good practice requires a user to cite the developer of open courseware as the source when using such materials.

Education Potential

Open courseware has the potential to expand curriculum offerings and significantly reduce the cost of curriculum development. This is especially true for courses that require illustration, demonstration, or experimentation. This potential to reduce the cost of curriculum development may be measured in both time and monetary savings.

Most open course materials are prepared by professors and instructors at the university level. These open course materials are particularly useful for curriculum expansion or development at universities and community colleges. They also are useful in grades 9-12 because

these grades typically include advanced or college-level courses. Educators also may be able to use open courseware — or some components — in other grades. Open course materials do not present an all-or-nothing proposition. Individual components may be integrated into existing curricula on a selective basis. This allows teachers to supplement their current course materials without added expense.

Open Courseware Distinctions

Although similar to other education materials that are distributed by electronic means, open courseware differs from these materials in several important ways. First, in spite of development costs, open courseware is distributed without charge in order to reduce the economic barrier to education. In contrast, most other types of education materials typically are sold at or above cost. Usually the development cost is funded under a specific grant or by the use of operational funds or self-initiative. Even then, there may be a charge to offset the cost of printing and distribution unless the materials are produced and distributed electronically. Second, open courseware is distributed electronically to minimize the cost of distribution. Other types of education materials often are available as hardcopies, as well as electronic copies, and a charge often is made for postage or "shipping and handling" of hardcopies. The following sections will explore how open courseware is distinct in more specific ways from other types of materials.

Original Source Materials

Although original source material is an important type of course material, open courseware does not generally include original source materials because of legal and economic factors. Original source materials are especially valuable in humanities courses (literature, history, economics, etc.) where they are integrated into the curriculum. Original source materials typically are published in traditional literary formats using fixed media. For example, news stories, essays, novels, histories, etc., are traditional literary formats; paper, tape, and disks are fixed media. Today, however, online media also may be original source material. An exception is where original source materials are in the public domain, such as the plays of William Shakespeare, or where these source materials are initially published as open courseware. Original source materials may be published initially either as trade publications or in scholarly journals. Publishers of trade publications and journals typically charge a cover price or a subscription fee. In this way, both publishers and authors recover costs and earn a return on their efforts.

If a trade book is successful, it may later be published as a mass-market paperback. The timing of the release of a mass-market paperback depends on the publisher's strategy for market segmentation. Once a book becomes a mass-market paperback, the paperback may remain in print for a very long time, depending on demand. However, many publishers continue to charge a price to cover the cost of production, distribution, and rea-

sonable markup. In contrast, open courseware is published online in digital format and without charge and so removes the economic barrier to access.

Public Domain Materials

Open courseware is copyrighted and its use is subject to the terms of a license. Even if the copyright may have expired on all components of open courseware, the compilation of these components is copyrighted because of the author's originality in selection and arrangement. Consequently, open courseware is not in the public domain unless so dedicated. For example, the mathematical theories and formulations contained in original works of Sir Isaac Newton and Gottfried Wilhelm von Leibnitz are clearly in the public domain. But open courseware lectures or problem sets containing arrangements of calculations based on these theories are copyrighted. Open source licenses are then made available to users, and the license typically includes the right to copy and distribute and may include the right to adapt (albeit with some restrictions).

Lesson Plans

Lesson plans are designed for a particular lesson or series of lessons. They are available online in many subjects. Although a lesson plan is an important planning tool, it is only a plan or outline of an intended lesson and does not include all of the components of a complete lesson. A lesson plan is analogous to a syllabus; it does not include all the components of the course.

In contrast, open courseware provides most — if not all — of the components required by a typical course. Open courseware may include 15 weeks of lectures, exercises, problem sets, and quizzes.

Distance Education

Contemporary distance education utilizes digital course materials that are published online. Distance education overcomes geographic barriers to curriculum but does not remove all barriers to access. Formal distance education is normally fee-based. In addition, enrollment in a particular course or distance education program may be limited, preventing some from joining.

Open courseware offers a solution to these non-geographic barriers. It allows teachers at many schools to offer the same course, greatly multiplying the number of seats available for students who wish to study the course materials in a formal setting. Moreover, other individuals may independently and informally study the course materials offered by open courseware.

Components of Open Courseware

Open courseware has significant value in curriculum development, whether or not all of the components required to teach a particular course are available. Open courseware that is available on an all-inclusive basis may be desired because it can be adopted in whole without additional curriculum development. Open courseware that provides components à la carte also may be desired because individual components can be selectively adopted and integrated to enhance an existing curriculum.

Typical Components

Open courseware is frequently based on course materials of university or college-level courses. Most open courseware provides up to five items: a syllabus, a reading list, lectures, in-class exercises, and out-of-class exercises. The extent of the components of open courseware varies. Open courseware may consist of a single lesson or a series of lessons, rather than a complete set of lessons for the semester. At a minimum, open courseware includes the instructor's syllabus and reading list necessary for students' preparation.

Open courseware often includes a professor's lectures that are required to teach a typical college-level course. Prior to the advent of open courseware, the lecture component was virtually inaccessible to non-attendees.

Open courseware also may include additional course materials for in-class lessons and exercises, as well as out-of-class readings and assignments. In-class exercises may incorporate reading, writing, calculating, speaking, or performing. Out-of-class exercises may include reading, writing, problem sets, or laboratory assignments. Some open courseware includes only the lectures and in-class exercises and not out-of-class readings and assignments because the latter are contained in an assigned textbook.

Optional Components

The developer of open courseware or a teacher using open courseware may wish to include optional components. For example, a professor developing open courseware may wish to require readings from public domain materials as an alternative to requiring the student to use a particular textbook or other copyrighted materials. In another example, a teacher using a previously developed course may wish to expand a course by including additional readings, such as sonnets by French poets as well as English poets in an advanced class in literature. If they are in the public domain, such readings from original sources may be scanned and distributed electronically or photocopied and distributed in class as handouts.

A developer of open courseware may wish to provide solutions to out-of-class assignments, such as problem sets, as a component of open courseware. A mathematics professor could provide the answers to problems found in the courseware. In this way, courseware would represent a nearly complete set of course materials.

Finally, a developer of open courseware may opt to provide quizzes or exams and their answers as a component of open courseware. Although it may appear counterintuitive, providing exams and answers is essential for assessment of students using open courseware. It is feasible that a courseware developer could provide a tool that generates exam questions and answers so that students with answers to previously asked questions do not gain an advantage. This is particularly true for math or science exams where problems and answers may be automatically calculated using symbolic representation of numbers as variables. For non-mathematical courses, a developer of open courseware may wish to provide a model exam as a component of open courseware. A model exam may include a typical question or series of questions requiring answers in prose form, such as essay responses.

Excluded Components

Certain curriculum materials, such as textbooks, are not generally included as components of open courseware. These materials contain copyrighted materials that are owned by other parties, including commercial publishers, and permission must be obtained to include

these copyrighted materials. The following course materials would typically be excluded as the components of open courseware: textbooks; course packs; articles, books, and other original source materials; and reference books. However, such materials need not be excluded if they are in the public domain.

Open Courseware Formats

Format tends to be of secondary importance to substance and frequently is viewed as merely a matter of style or aesthetics. However, from a design perspective the format of open courseware may have substantial importance. Design professionals sometimes claim that form follows function. Format should depend on the intended purpose. Because the purpose of open courseware includes wide distribution of course materials free of charge as well as ease of integration into existing curricula, the format of open courseware must support these purposes.

Digital Format. The trend is toward digital course materials. Open courseware is no exception. In preparation for electronic distribution, existing information is converted to digital format, or "digitized." Newly created information may be generated directly in digital format. Today, the Internet represents the preferred method of distribution of digital course materials, although other electronic methods are available, such as e-mail.

Portable Format. Open courseware must be published in portable formats that ensure accessibility. Portable

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formats enable access to documents and files because these formats support interoperability. There exist various portable formats, each of which may be used in open courseware applications. These portable formats include hypertext markup language (HTML), plain unformatted text (or ASCII format), rich text format (RTF), graphical interchange format (GIF), portable document format (PDF), and extensible markup language (XML). Each of these different formats is portable. The selection of one over another will depend on design and usage factors, as well as on the courseware's subject matter, origin, and the resources available to the courseware originator.

Presentation Format. A factor in the choice of presentation format is the nature of the content. Rich content is electronically complex; it may include movement, such as animation or streaming video, or sound. Some subjects, such as physiology of the human body, may demand substantial "richness" (by means of graphics) to convey the subject matter effectively. On the other hand, a lecture in the humanities may require little rich content.

Open courseware should demonstrate a balance between plain and rich content. Assuming each component of open courseware is published using a suitable format, a balance could be obtained by publishing some components in a plain format and other components in a rich format. For example, the syllabus and reading lists would likely be published in plain format, while in-class exercises and computer simulations might be published

in rich format where dynamic interaction is necessary or beneficial.

Making Curriculum Decisions

Effective integration of new course materials depends on the needs of the particular teacher, department, school, and school district. It also depends on the nature of the existing curriculum and the degree of curriculum change sought or desired. For example, an existing course may need to be updated to reflect new developments in science, history, and so on. New courses sometimes must be offered to satisfy consumer demands or legislative mandates. These curriculum changes may require resources that are not available in a school or school district. Open courseware can be used in the curriculum to meet pressing needs in a low-cost or no-cost manner.

Open course materials may be integrated into a curriculum in more than one way, from full course adoption to selective adoption of particular components. Materials from an open course may be adopted in total in order to establish a new course. A high school that does not presently offer calculus, for example, might adopt a complete open course. Course materials from an open course might be partially adopted in order to enhance or improve an established course. Or a teacher

may selectively adopt individual materials from an open course, for example, to reinforce a specific lesson.

Types of Use

The school principal, department, and district will influence the overall curriculum strategy with respect to integration of open courseware. But it usually is left to the teacher to determine which methods to employ to integrate new course materials into the curriculum.

Individual Use. A teacher may decide that each student will individually review or study particular course material online. Individual use allows a student to work on assignments, such as reading a book or play, at his or her own pace. Open courseware may eventually eliminate the need to purchase trade copies of classic literary works because such works often are in the public domain and may be obtained electronically without cost. A student also may elect to use open courseware for independent study of a subject area.

Group Use. Students may be assigned to work together on a particular topic, and the teacher may find open courseware useful. Open courseware can allow groups to observe online computer simulations of laboratory experiments, for example, that the group will replicate in class. Or students may observe experiments that are beyond the capacity of their school. In instances such as these, open courseware complements or expands the existing curriculum.

Single Classroom Use. Teachers may decide to use open courseware with a whole class to complement or ex-

pand a lesson. For example, a teacher might display a picture from open courseware as part of the presentation of a lesson in the classroom. Teachers may make multiple copies of certain open course materials as student handouts. Open courseware permits the displaying and copying of these course materials because these are noncommercial uses that do not require prior permission.

Multiple Classroom Use. A department may wish to use open courseware in order to offer multiple classes or sections of a particular subject. Open courseware gives an experienced teacher the flexibility to teach a new subject area without the necessity of developing new course materials. In addition, open courseware allows for the use of materials in multiple classrooms without charge and without the necessity of obtaining permissions. In this way, the department may increase the number of seats available to students while maintaining or reducing class sizes.

Large Audience Use. A teacher may wish to use open courseware with large audiences. Open courseware permits public performances of course materials in auditoriums and broadcasts if they are non-commercial. With open courseware, a drama or music teacher may perform a play or song to a large audience without worrying about copyright. Open courseware presents fewer problems than other copyrighted materials that require permission or payment of a royalty fee for both commercial and non-commercial use.

Adjusting Open Courseware

The majority of sources for open courseware are university educators. Much open courseware is designed for delivery in a structured format of approximately three hours of lecture per week and two hours of additional time for discussion groups. Laboratory components of open courseware generally are designed to be two to four hours of laboratory experimentation each week.

The adoption of open courseware by a college or university can depend on whether the originating institution is on the semester system or the quarter system. If the adopting university or college has the same system as the originating institution, then the adoption will be relatively simple. Many universities that develop open courseware are on the semester system. If the adopting university is on a quarter system, the university may need to break the open courseware into smaller segments.

Adoption of open courseware by a high school is only slightly more complicated than for a university. For lecture classes, a high school could deliver an approximately one-hour lecture on Monday, Wednesday, and Friday, with discussion groups on Tuesdays and Thursdays. The proposed lecture schedule corresponds to a typical schedule commonly used by universities, except that universities may offer alternative schedules at different times of the day or days of the week to accommodate large numbers of students. For laboratory classes, a high school delivery could include a one-hour

setup on Monday and a two-hour laboratory on Tuesday or Wednesday each week. A proposed laboratory schedule with a lab set-up one day and a lab the next day corresponds to a typical schedule commonly required for laboratories at universities.

Case Studies

Open courseware shows promise for significant expansion. A number of educators and institutions have pioneered the path. Following are three case studies of open courseware. Each briefly discusses the origin of the courseware and its significance to an extended audience of users at other institutions.

Case No. 1: Managing the Digital Enterprise

Launched in 1999 by Professor Michael Rappa at North Carolina State University, Managing the Digital Enterprise is a graduate course that addresses 15 topics related to the management of an e-business, or any business enterprise in the digital age. In part because of the subject matter, the course relies solely on Internet resources for its components, and no traditional textbook is required. The course materials include lectures, readings, and assignments organized in weekly units. This course, similar to other open courseware, is accessible via the Internet, thereby enabling global distribution of the course materials posted on the website. At this time, use of the course materials is free to the public without

restriction as to commercial use. The audience for the course includes for-profit corporations in addition to colleges and universities. Given the graduate level of the course, the course does not appear to have been adopted by community colleges or secondary education.

Case No. 2: The Harvey Project

Begun in July 1998 at Wayne State University, the Harvey Project addresses the subject of physiology. The Harvey Project was named for Sir William Harvey, the English physician who discovered the circulation of blood. The goal of the Harvey Project is to develop course materials that accurately demonstrate detailed aspects of the human physiology using dynamic graphics. These course materials can be more effective in learning than the study of static anatomical illustrations, such as those found in textbooks. Although dynamic graphics are available on fixed media (CD-ROM), they are prohibitively expensive to many students and are subject to the memory limitations associated with fixed media. The Harvey Project has enabled development of dynamic graphics having more features than prior dynamic graphics, without undue memory constraints, and without charge to users. Like other open courseware, the Harvey Project is distributed on the Internet to minimize costs while enabling wide distribution. The users of the Harvey Project include many universities and colleges. It should be noted that the Harvey Project is a work in progress and continues to grow in course materials and number of participants.

Case No. 3: MIT's Biology Hypertextbook

Begun in the 1990s at the Massachusetts Institute of Technology, MIT's Biology Hypertextbook addresses the field of biology. The MIT Biology Hypertextbook includes selected course materials for courses in introductory biology corresponding to courses at MIT and includes those course materials typically found in a traditional textbook, such as readings and practice problems organized by chapter. In addition, the electronic textbook includes quizzes and uses hypertext links to navigate through the course materials. By compiling these digital course materials and producing an electronic text, MIT avoided the requirement of a hard-copy textbook. The resulting electronic text supports dynamic content. Given the popularity of this course at MIT, it is likely that other open courseware may be developed in the form of electronic texts.

Other Considerations

Approaches to open education systems are varied. And these approaches may use confusingly similar terminology in their descriptions. One university may offer enrollment in "open courses" while another university may publish "open courseware." Open courses are not necessarily synonymous with open courseware. Open courses may simply refer to courses offered by an open university. Under those circumstances, course materials may not be copied or distributed except with permission and would typically not be available without charge. Therefore, readers who intend to make use of open courseware are cautioned to confirm in advance that what appears to be open courseware is actually available for use without charge.

Authors of open courseware retain the copyright to the course materials. For example, professors would retain the copyright to their lectures and class presentations. Therefore the use of open courseware is subject to the terms of the license granted by the authors. Open courseware is not for commercial use and therefore not for resale. Despite these protections, authors may be

concerned that control of the copyright to their course materials may be lost, given the digital nature of courseware. When professors realize that some of their course materials — in particular their lectures — could be effectively used by others while at the same time maintaining their rights to use these materials commercially, they will be less reluctant to contribute course materials for use as open courseware.

Although open courseware allows significantly greater accessibility to course materials, open courseware will not be accessible to all prospective users until it is published in multiple languages. Open courseware usually is published only in the primary language of the courseware's developer. Automated translation can be helpful but may not always be effective for sophisticated communication. Open courseware may be initially published in a single language, and subsequent users of the open courseware may translate the materials into other languages — subject to the terms of a license.

Conclusion

We stand at a new frontier in curriculum development, just as the Internet was a new frontier in communication. Pioneering faculty at several institutions publish course materials as open courseware for use by students and teachers. Current users are primarily students and faculty at other universities or community colleges. As the number of users increases, additional models of use are emerging, including use by teachers in secondary education, especially teachers of advanced classes.

Educators are anticipating phenomenal growth in the volume of new courseware offerings. In April 2001, the Massachusetts Institute of Technology (MIT) announced the planned release of extensive open courseware in diverse fields of study, including subjects of interest for grades 9-12. At the present time, many new offerings of open courseware are in development at MIT. The initial set of 100 courses was released in September 2002 to be followed by additional sets of courses in subsequent years. Courseware offerings are anticipated to include thousands of courses in many fields, such as aeronautics

and astronautics; anthropology; architecture; biology and biological engineering; brain and cognitive sciences; chemical engineering; chemistry; civil and environmental engineering; comparative media studies; earth, atmospheric, and planetary sciences; economics; electrical engineering and computer science; foreign languages and literatures; health, sciences, and technology; history; linguistics and philosophy; literature; business or management; materials science and engineering; mathematics; mechanical engineering; media arts and sciences; music; nuclear engineering; ocean engineering; linguistics and philosophy; physics; political science; science, technology, and society; urban studies and planning; theater arts; women's studies; and writing and humanistic studies.

Open courseware affords educators the opportunity to expand the existing curriculum offerings or to strengthen their existing curriculum without the time and expense of developing course materials. Open courseware represents a valuable new education product in the marketplace for grades 9-12. Open courseware has advantages over other potential course materials in the curriculum. In addition, open courseware includes course materials not traditionally available elsewhere. The introduction of open courseware will likely enlarge the educational marketplace and provide competitive sources to obtain curriculum resources similar in effect to public domain materials.

Resources

Online resources were surveyed during 2002 to determine which are currently published or planned for release as open courseware. The following lists are based on that survey and are organized by source and by subject area. While some sources provide only lesson plans, others provide comprehensive course materials including most, if not all, components necessary for teaching a course. Readers should bear in mind that the Internet is constantly in flux; websites were accurate at the time this fastback was written but may have changed in the meantime.

By Source

AskERIC – part of Educational Resources Information Center (ERIC)
Clearinghouse on Information and Technology
Syracuse University and U.S. Department of Education
http://www.askeric.org

AskERIC is a web interface to the educational resources of the 16 ERIC clearinghouses.

The Center for Computer-Assisted Legal Instruction (CALI)
University of Minnesota and Harvard University
http://www.cali.org

CALI is a nonprofit consortium of law schools that researches and develops computer-mediated legal instruction and supports institutions and individuals using technology in legal education.

CIBERweb – part of Centers for International Business Education and Research (CIBER)
Purdue University and U.S. Department of Education
http://ciber.centers.purdue.edu

CIBERweb is a web interface to the educational resources of the more than 20 CIBER centers.

Community Learning Network (CLN)
Open Learning Agency
http://www.cln.org/themes_index.html

CLN is funded in part by the Canadian government to promote education through development of educational materials.

Compendium of Open Courses and Open Course Resources
Scott R. Anderson
Sandia Research and Computing
http://www.opencourse.info

Foundation for Teaching Economics (FTE)
http://www.fte.org

FTE is a non-profit foundation that provides extensive educational resources in the field of economics.

The Harvey Project
Wayne State University
http://harveyproject.org

The Harvey Project is a collaboration of interested individuals and institutions to develop a dynamic, interactive courseware in the field of physiology.

Managing the Digital Enterprise (e-biz)
Michael Rappa
North Carolina State University
http://digitalenterprise.org

MDE is a nearly complete course on the subject of management of the digital enterprise.

MIT Biology Hypertextbook
Massachusetts Institute of Technology (MIT)
http://web.mit.edu/esgbio/www/

MIT Biology Hypertextbook is an electronic text for courses in introductory biology at MIT.

MIT Open Courseware (MIT OCW)
Massachusetts Institute of Technology (MIT)
http://ocw.mit.edu

MIT OCW is a large-scale initiative to publish online course materials of all courses taught at MIT and includes diverse subject areas.

Reading Online
International Reading Association
http://www.readingonline.org

IRA is an international association that produces educational resources in areas of teaching reading and literacy.

The UK Mathematics Courseware Consortium
http://www.bham.ac.uk/mathwise

This resource is a consortium that produced Mathwise (TLTP version), a computer-based learning package for mathematics available to institutions of higher education in the United Kingdom.

Virtual Laboratory (VLAB)
University of Oregon
http://jersey.uoregon.edu

VLAB is a university department whose members create educational materials in a virtual environment.

Vision Learning
http://www.visionlearning.com

Vision Learning is a web interface to educational resources, including chemistry and basic sciences, and enables high-quality, content-rich web classrooms.

By Subject Area

Subject Area	*Source(s)*
Aeronautics and Astronautics	MIT
Anthropology	MIT
Architecture	MIT
Art	CLN
Astronomy and Astrophysics	VLAB
Biology and Biological Engineering	Biology Hypertextbook, MIT
Brain and Cognitive Sciences	MIT
Business (see also Management)	CIBER, Digital Enterprise, MIT

Career Studies	CLN
Chemical Engineering	MIT
Chemistry	Vision Learning MIT
Civil and Environmental Engineering	MIT
Comparative Media Studies	MIT
Earth, Atmospheric, and Planetary Sciences	VLAB, MIT
Economics	FTE, MIT
Electrical Engineering and Computer Science	MIT
English as a Second Language	CLN, MIT
Foreign Languages and Literatures	MIT
Health, Sciences, and Technology	CLN, MIT
History	MIT
Law	CALI
Linguistics	MIT
Literature	MIT
Management (see also Business)	CIBER, Digital Enterprise, MIT
Materials Science and Engineering	MIT
Mathematics	CLN, TLTP, MIT
Media Arts and Sciences	MIT
Medicine	The Harvey Project
Multiculturalism	CLN
Music	MIT
Nuclear Engineering	MIT
Ocean Engineering	MIT
Philosophy	MIT
Physical Education	CLN
Physics	VLAB, MIT

Physiology	The Harvey Project, MIT
Political Science	MIT
Reading and Literacy	IRA, CLN
Science, Technology, and Society	MIT
Social Studies	CLN
Technology Education	MIT
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Women's Studies	MIT
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